

## CLAIMS

What is claimed is:

1. A laser system comprising:
  - a fuel supply system configured to provide fuel products, wherein the fuel products comprise at least a solid fuel;
  - a laser configured to receive the fuel products from the fuel supply system and to produce at least a solid waste product and a gaseous waste product from the fuel products; and
  - a fuels regeneration system configured to receive the solid waste product at a solids processing system and the gaseous waste product as a gas processing system, and wherein each of the solid and gas processing systems cooperate with a reagent production system to replenish the fuel products in the fuel supply system.
2. The laser system of claim 1 wherein the solid fuel comprises a hydrogen halide.
3. The laser system of claim 2 wherein the fuel products further comprise a metal peroxide.
4. The laser system of claim 1 wherein the solid fuel comprises a deuterium halide.
5. The laser system of claim 4 wherein the fuel products further comprise a metal peroxide.
6. The laser system of claim 1 wherein the reagent production system comprises a chlor alkali portion configured to electrolyze a salt produced by the laser.
7. The laser system of claim 6 further comprising a peroxide generator.
8. The laser system of claim 7 wherein the peroxide generator is configured to receive heavy water from the gas processing system and to produce deuterium peroxide.

9. The laser system of claim 8 wherein the reagent production system further comprises a preactor configured to receive chlorine and deuterium from the chlor-alkali portion and to produce deuterium chloride therefrom.
10. The laser system of claim 7 wherein the peroxide generator is configured to receive water from the gas processing system and to produce hydrogen peroxide.
11. The laser system of claim 10 wherein the reagent production system further comprises a photoreactor configured to receive chlorine and hydrogen from the chlor-alkali portion and to produce hydrogen chloride therefrom.
12. The laser system of claim 1 wherein the laser is configured to process a metal peroxide and a deuterium halide to form a salt, heavy water and singlet delta oxygen.
13. The laser system of claim 1 wherein the laser is configured to process a metal peroxide and a hydrogen halide to form a salt, water and singlet delta oxygen.
14. A chemical oxygen iodine laser (COIL) system comprising:
  - a fuel supply system configured to provide fuel products, wherein the fuel products comprise metal peroxide and deuterium halide;
  - a COIL configured to receive the fuel products from the fuel supply system and to produce a solid waste product comprising metal halide and a gaseous waste product comprising oxygen and heavy water from the fuel products; and
  - a fuels regeneration system configured to receive the solid waste product at a solids processing system and the gaseous waste products as a gas processing system, and wherein each of the solid and gas processing systems cooperate with a reagent production system to replenish the fuel products in the fuel supply system, and wherein the reagent production system comprises a peroxide generator, an alkali processing cell and a reactor.

15. The COIL system of claim 14 wherein the peroxide generator is configured to receive the oxygen and heavy water from the gas processing system and to produce peroxide therefrom.
16. The COIL system of claim 15 wherein the alkali processing cell is configured to receive the metal halide and to produce deuterium halide therefrom.
17. The COIL system of claim 16 wherein the reactor is a photoreactor configured to receive deuterium and halide from the alkali cell and to produce deuterium halide therefrom.
18. The COIL system of claim 16 wherein the alkali processing cell and the peroxide generator are provided within a common housing, and wherein the alkali processing cell is separated by the peroxide generator by a membrane.
19. A fuel regeneration system (FRS) for recovering solid and gaseous fuels for a laser, the FRS comprising:
  - a solids processing system configured to receive solid waste from the laser and to separate at least a portion of the solid fuels from the solid waste;
  - a gas processing system configured to receive gaseous waste from the laser and to separate at least a portion of the gaseous fuels from the gaseous waste; and
  - a reagent production system coupled to the solids processing system and the gas processing system to receive remaining solid and gaseous waste, respectively, wherein the reagent production system is configured to process the remaining solid and gaseous waste to thereby regenerate the solid and gaseous fuels for the laser.
20. The FRS of claim 19 wherein the solid fuels comprise metal peroxide.
21. The FRS of claim 20 wherein the remaining solid waste comprises a metal hydride.

22. The FRS of claim 21 wherein the remaining gaseous waste comprises oxygen and water.
23. The FRS of claim 21 wherein the remaining gaseous waste comprises oxygen and heavy water.
24. A solid generator laser comprising a fuel supply system and a laser generator and optics module, wherein the fuel supply system is configured to retain a solid fuel and a gaseous fuel; and wherein the laser generator and optics module is configured to receive the solid and gaseous fuels from the fuel supply system, to produce laser light from the solid and gaseous fuels, and to generate waste products therefrom.
25. The solid generator laser of claim 24 further comprising a sealed exhaust system configured to receive at least a gaseous portion of the waste product
26. A method of operating a solid generator laser system having a laser and a fuel supply system, the method comprising the steps of:
  - providing a solid fuel and a gaseous fuel from the fuel supply system to the laser;
  - firing the laser to thereby convert at least a portion of the solid fuel and at least a portion of the gaseous fuel to waste products, wherein the waste products comprise a solid portion and a gaseous portion;
  - recovering the solid and gaseous portions from the laser; and
  - processing the solid and gaseous portions of the waste products to regenerate the solid fuel and the gaseous fuel therefrom.
27. The method of claim 26 wherein the solid fuel comprises a metal peroxide and the gaseous fuel comprises a halide.
28. The method of claim 27 wherein the solid portion of the waste products comprises metal halide and wherein the gaseous portion comprises oxygen and heavy water.
29. The method of claim 28 wherein the processing step comprises the step of electrolyzing the metal halide to restore the halide.

30. The method of claim 29 wherein the processing step further comprises the step of oxidizing heavy water to produce peroxide.
31. The method of claim 27 wherein the solid portion of the waste products comprises metal halide and wherein the gaseous portion comprises oxygen and water.
32. The method of claim 31 wherein the processing step comprises the step of electrolyzing the metal halide to restore the halide.
33. The method of claim 32 wherein the processing step further comprises the step of oxidizing heavy water to produce peroxide.
34. A solid generator laser system having a laser and a fuel supply system, the laser system further comprising:  
    means for providing a solid fuel and a gaseous fuel from the fuel supply system to the laser;  
    means for firing the laser to thereby convert at least a portion of the solid fuel and at least a portion of the gaseous fuel to waste products, wherein the waste products comprise a solid portion and a gaseous portion;  
    means for recovering the solid and gaseous portions from the laser; and  
    means for processing the solid and gaseous portions of the waste products to regenerate the solid fuel and the gaseous fuel therefrom.